IMPACTS OF CASTRATION AND DOCKING METHOD ON LAMB STRESS AND PERFORMANCE

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ABSTRACT

The objectives of this study were to determine which method of castration and docking causes more stress to lambs and subsequent effects on performance. For this study 60 crossbred lambs, 31 females and 29 males, were assigned to one of two treatment groups. Female lambs were docked while male lambs were castrated. Lambs were docked or castrated with either an All-in-One tool or by elastrator rubber band. Ewe lambs docked with an elastrator band were more restless than lambs docked with an All-in-One ($p < 0.01$). There were no differences in mean 93 day weight between ewe treatments ($p = 0.93$). Male lambs castrated with an elastrator band vocalized more ($p = 0.03$) and were more restless than lambs castrated with an All-in-One ($p = 0.05$). Mean 93 day weight was affected by treatment with banded males weighing more than All-in-One castrated males ($p = 0.03$). Results suggest that castration method can affect performance while docking method does not.

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INTRODUCTION

Castration is a common animal husbandry practice intended to decrease unwanted pregnancies, prevent aggressive behavior and increase meat quality (Thornton and Waterman-Pearson, 1999; Capucille et al., 2002; Coetzee et al., 2010). Docking is also a common animal husbandry practice meant to decrease fecal soiling and fly strike (AVMA, 2014b). Because castration and docking methods can cause pain, animal welfare is an issue with castration and docking.

There are various methods of castration and docking, some appear to be more stressful than others (Kent et al., 2001; Thornton and Waterman-Pearson, 2002; Melches et al., 2006). Producers use different methods as well as castrating or docking at different ages or time periods (pre-weaning, post-weaning) depending on personal experience, convenience and history. The age of an animal at the time of castration has been shown to have an effect on pain behaviors and growth characteristics (Bretschneider, 2005; McCracken et al., 2010). Stress caused by castration or docking can lead to decreased weight gain which can affect market value for producers. It is important to determine which method causes the least pain and greatest weight increases for producer's interests. This will ensure proper animal care and the best return for producers. The objective of this study is to determine which castration and docking method causes the least amount of pain indicating behaviors and optimize weight gains. This study will test the hypotheses that the rubber band method will produce less pain indicative behaviors than the surgical method and that at 90 days of age, lambs treated with rubber band will weigh more than lambs treated surgically.

OBJECTIVES

1. Determine which castration/docking method causes the least amount of pain
2. Determine which castration/docking method optimizes weight gain

LITERATURE REVIEW

Benefits of Castration

Castration is a painful husbandry practice that is common in agriculture (Grant, 2004). Many scientists have documented benefits of castration. Castration prevents unwanted breeding and allows producers to place males and females together when space is limited (Thornton and Waterman-Pearson, 1999; Capucille et al., 2002; Coetzee et al., 2010). Prevention of injury by sexually related behaviors (mounting, chasing) is another benefit of castration (Mach et al., 2009; Thornton and Waterman-Pearson, 1999). Castration can also decrease aggressive behavior that could be destructive to facilities or harm humans or animals in confinement (Capucille et al., 2002; Coetzee et al., 2010).

Studies have also shown that castration can improve meat quality by increasing tenderness and marbling (Thornton and Waterman-Pearson, 1999; Capucille et al., 2002; Coetzee et al., 2010). Although intact males gain faster than castrated males, it has been found that intact males have a lower meat quality and decreased palatability (Worrell et al., 1987).

Methods of Castration

There are various methods of castration, surgical, non-surgical or chemical. Non-surgical methods involve cutting off blood supply to the testes. Rubber ring castration, a non-surgical technique, is performed by placing a tight rubber ring proximal to the testes around the scrotum. The decreased blood flow to the testes eventually leads to tissue death and sloughing of the scrotum (Melches et al., 2006). Another non-surgical technique, the short scrotum method, utilizes a rubber ring. In this method, the rubber ring is applied distal to the testes pushing them against the abdominal wall. This increases teste temperature causing

infertility (Lester et al., 1996). In both procedures, it is important that the band be applied correctly to avoid complications. Tetanus has been reported with banding, so tetanus vaccinations should be given prior to castration (Capucille et al., 2002).

Burdizzo castration uses a clamp to crush the spermatic cords. This method leaves the scrotum intact making it difficult to tell if treatment was successful (Melches et al., 2006). Burdizzo castration eliminates the risk of hemorrhage and infection but should only be performed on immature males (Capucille et al., 2002).

Surgical castration can be performed in a variety of methods, involving incision of the scrotum, extracting of the testes and in some cases, closing of the scrotum. This can be done using a scalpel or sharp knife. Hemorrhage and infection are common in this method of castration (Capucille et al., 2002), often requiring follow-up treatment.

Chemical castration involves injecting an agent, such as lactic acid, into the testes which causes irreparable damage and loss of fertility. This method demands a higher level of skill from the practitioner as well as having an extended healing time over other methods (AVMA, 2014a). Immuncontraceptives can be used to produce antibodies that reduce the amount of reproductive hormones. While this method does have some benefit in animal growth and performance, multiple injections are needed and sexual behaviors can persist for months after treatment (AVMA, 2014a).

Timing of Castration

Scientists suggest that animals be castrated as early as possible (Melches et al., 2006; Capucille et al., 2002). However, in some cases, producers may choose to delay castration. Some cattle producers believe that delaying castration will take advantage of an intact male's ability to gain while retaining the carcass characteristics of castrated males (Worrell et al.,

1987). Bretschneider (2005) found that when calves were castrated at birth, weight loss was low or completely absent. Calves castrated at birth will have similar weaning weights as calves castrated at weaning. However, when calves were castrated at weaning, they suffered post-castration weight loss and were at a disadvantage at the beginning of the finishing stage. Weight loss associated with castration will increase as age increases. Another study discovered that when calves were castrated at two months of age, they weighed less at weaning than calves castrated at ten months of age. However, the ten month old cattle gained slower than earlier castrated cattle between 10 and 20 months of age (Micol et al., 2008). Younger animals may also have a higher sensitivity to pain after castration. McCracken et al. (2010) observed pain behaviors after castration and tail docking in two separate age groups of lambs. Lambs were castrated at one day of age or ten days of age then tail docked at one month of age. Lambs that were castrated at day one showed more pain indicative behavior at tail docking than the day ten lambs. In contrast, Keane (1999) found that pre-pubertal castration was less painful and there are no advantages to delaying castration.

Potential Impacts of Castration on Production

Producers should be concerned with how castration will affect animal growth. Most studies evaluating animal performance after castration have been done with cattle. It has been found that species react differently to castration (Mellor et al., 1991). Intact males were found to be more efficient in the feedlot (Worrell et al., 1987). Intact males had higher average daily gain (ADG) than castrated males while consuming the same amount of feed. The method of castration did not affect ADG among castrated cattle and castrated males grew slower than intact males (Bretschneider, 2005). Calves castrated after weaning gained less than calves castrated pre-weaning. Post-castration, ADG was affected by the method of

castration for 14 days. However, for the 84 day experiment period, ADG was similar among treatments. This suggests that calves can compensate for weight loss post-castration. Any castration method used in this study decreased ADG when compared to the control group (castrated pre-weaning) (Warnock et al., 2012). Daily concentrate intake was not affected by castration, but castration decreased ADG, final body weight and hot carcass weight when compared to intact males (Mach et al., 2009).

A study involving lambs found that surgical groups lost weight two days post-treatment while rubber ring, burdizzo and control groups maintained weight or gained weight. After day 21, there was no difference in weight between groups, suggesting that lambs are also able to compensate for weight loss post-castration (Melches et al., 2006).

Impacts on Animal Behavior and Pain Responses

Pain in animals is hard to measure and interpret. Pain response differs across species and by individual. Animals convey pain by certain postures, behavior, and cortisol levels. Cortisol levels are also indicative of stress in animals. It has been found that cortisol levels increase after castration (Thornton and Waterman-Pearson, 2002; Bretschneider, 2005). Method of castration also affects cortisol levels (Boesch et al., 2008) with rubber ring and surgical treatments having the highest levels (Kent et al., 2001; Thornton and Waterman-Pearson, 2002; Melches et al., 2006). Combining the burdizzo with a ring produced lower cortisol levels than a rubber ring or burdizzo alone (Kent et al., 1995).

A study found that combining the rubber ring and burdizzo method produced the least active pain behavior (restlessness, etc.) while rubber ring produced the most active pain behavior. The combined method is painful at application but little pain is experienced after the procedure because the clamp from the burdizzo destroys all nerve endings and lambs

don't feel the blocked blood flow usually associated with ring castration. Rubber ring and surgical castration produced the highest unresponsive pain behavior (lying or standing still). The combined method decreases active pain behavior as well as unresponsive pain behavior leading to the conclusion that combining the burdizzo with a ring decreases pain (Thornton and Waterman-Pearson, 1999).

In 2002, Thornton and Waterman-Pearson set out to define normal behaviors in unstressed lambs to be better able to identify abnormal pain indicative behavior. Castration resulted in less time lying and more time performing abnormal postures in four to six week old lambs. Castration method had no significant difference between behaviors, but the combined method decreased lying and abnormal postures in four to six week old lambs. The combined band and burdizzo method also lowered gamboling (playful behavior) in one week old lambs. Four to six week old lambs had an increase in abnormal postures. Changes in behavior indicate a degree of pain. This study also found that castration affects behavior for longer than just a few hours on the day of castration. An extended change in behavior can impact growth and performance by affecting eating habits, thus affecting weight gain.

A study by Melches et al. (2006) used three different methods of castration (rubber ring, surgical, and burdizzo) and monitored lambs during and after the procedure. Surgical and burdizzo lambs showed more pain behaviors during the procedure than rubber ring groups. However, immediate painful behaviors were exhibited more in the burdizzo group but they healed faster than other groups. Rubber ring groups took the longest to heal. Surgical groups were less likely to eat on the day of castration and demonstrated more abnormal postures. Lambs were palpated after the procedure to determine residual pain response. Burdizzo groups showed a greater pain response to palpation than rubber ring

groups followed by the control group which was not castrated. Surgical groups experienced more complications and the procedure took longer which makes this technique unlikely for producers when using anesthesia and analgesia.

Lester et al. (1996) studied lambs for the first four hours after castration or tail docking. Behaviors studied were restlessness, normal walking/standing, abnormal walking/standing, ventral lying, lateral lying, tremors and sleep. Tremors were hard to distinguish due to breathing and sleeping was not observed in any lamb. Various treatment groups were utilized including a control (handled only) group. Treatment groups (n = 9, 10) used ring and knife castration methods, ring, knife, and iron tail docking methods and combined castration-docking methods. All castrated groups, regardless of technique, exhibited higher incidences of abnormal standing or walking than control lambs. All groups that used a ring exhibited restlessness that peaked around 30 minutes post-treatment. Lying was more common during the first 90 minutes in ring groups with high amounts of abnormal lying. All walking and standing was abnormal in ring groups but normal behavior returned within four hours. Lambs that were castrated with a knife did not exhibit restlessness but abnormal standing/walking was the major displayed behavior while all lying observations were normal. Lambs castrated by knife experienced distress longer than the four hour observation period suggesting that rings cause less stress than use of a knife. This disputes Molony et al.'s (1993) findings.

Molony et al. (1993) studied the behavior response of young lambs to three methods of castration at three different ages using a control group (handled only) as well as a rubber ring group, a surgical group and a burdizzo combined with rubber ring group. The tail docking technique used by Molony was similar to that of the castration method. The surgical

procedure in Molony et al. (1993) differs from the "knife" procedure used by Lester et al. (1996). Molony made a vertical incision along the scrotum, clamped the spermatic cord before cutting then cauterizing it while Lester removed the bottom third of the scrotum and pulled the testicles out using tongs. The rubber ring groups were treated similar between the studies. Molony et al. observed that restlessness scores were increased in rubber ring groups and older age groups. Older lambs exhibited less abnormal lying than younger lambs. Regardless of age, lambs that were castrated by rubber ring spent more time in abnormal postures and had higher levels of restlessness. Surgical treatment groups exhibited less abnormal lying than rubber ring groups but had similar values in regards to abnormal standing. Surgical lambs spent more time "statue standing" (standing with minimal movement) than other groups. Molony et al. (1993) concluded that rubber rings produced more pain at all ages than other methods but combining a burdizzo with a rubber ring can reduce pain experienced by lambs.

Previous studies (Melches et al., 2006) regarding growth performance in lambs post-castration have used pain mitigation and anesthesia which could have an effect on weight loss. There is also controversy between studies regarding which procedure is most painful. Some researchers say that banding is more painful while others say that surgery is more painful for lambs. The current study aims to mimic range conditions and procedures that sheep producers are most likely to use in their operation.

MATERIALS AND METHODS

This study was conducted on the Angelo State University Management, Instruction, and Research Center in San Angelo, Texas. All methods were approved by the Angelo State University Institutional Animal Care and Use Committee (#15-01). Sixty cross-bred (Suffolk x Rambouillet) lambs were used for this study; 31 females and 29 males. Lambs were randomly assigned to one of two treatment groups with a total of 30 lambs per treatment. Treatment 1 included 14 males and 16 females. Treatment 2 included 15 males and 15 females. At seven to 14 days of age, lambs were taken out of pasture and put into pens with their dams. All lambs that had a dry umbilical cord were determined to be old enough for treatment and were separated from their dam and placed in a small pen. Lambs were ear tagged with an individual number. Prior to treatment, all lamb weights were recorded. Lambs were also given clostridium (Boehringer Ingelheim), tetanus (Boehringer Ingelheim), and soremouth (Texas A&M University) vaccinations to prevent illness. Female lambs were tail docked while male lambs were castrated.

Treatment 1 lambs were castrated or docked by an All-in-One tool. The All-in-One castration method involved removing the bottom third of the scrotum to expose the testes. The testes were then pinched with the All-in-One tool and removed. The All-in-One docking method involved cutting of the tail at the caudal fold. Treatment 2 lambs were castrated or docked using an elastrator rubber band. The rubber band castration method involved placing a tight rubber band proximal to the testes around the neck of the scrotum to cause a reduction in blood circulation to the testes which then causes death of tissue and sloughing of the scrotum. The rubber band docking method involved placing a rubber band around the tail at

the caudal fold and then removing the bottom two inches of the tail to allow blood to drain and aid in tail drying and sloughing of the tail.

Behaviors were recorded for a 40 minute period by a team of observers. Prior to the beginning of the study, a pre-test was performed to determine the length of an observation period. After 60 minutes, lambs in the pre-test were observed to be exhibiting normal behaviors such as sleeping and nursing. A 40 minute observation period was then deemed adequate time to observe behavior. The team of observers were trained on how to observe the lambs and record lamb behavior on a data sheet.

After treatment was performed, lambs were placed in a small pen with the other treated lambs. Behaviors recorded include the number of vocalizations per minute and number of times a lamb stands and lays down which determines restlessness. A point was given each time a lamb stood and a point for each time it laid down. Observations were recorded each minute for the first ten minutes and then for a one minute duration at ten minute intervals until 40 minutes. After observation concluded, lambs were returned to the pen with their dam. After 20 minutes with their dam, an observer walked through the pen to find each lamb and gave them a behavior score based on observed behavior. The same observer was used to record all behavior scores to limit the variation of behavior scores. The scores ranged from 1 to 5 with 1 being agitated and 5 being normal behavior. After the behavior assessment was completed, lambs and dams were returned to pasture.

Up to a week after treatment, lambs were gathered from pasture to dock tails on all treated males and to castrate or dock the next group of lambs. Treated male lambs were tail docked using the same All-in-One method used for female lambs. Lambs were weighed again at an average 22 days of age and an average 93 days of age.

Variables that were analyzed were the means for each stress related behavior and the post-procedure weight gain. The Generalized Linear Models (GLM) procedure in SAS (Cary, North Carolina) was used to compare means between treatments. Duncan's Least Significant Difference (LSD) test was used to separate the means. Treatments are considered different at $p \leq 0.05$. However, trends are recognized at $p \leq 0.1$.

RESULTS

Audible Stress Behavior

Females did not exhibit differences in vocalizations between treatment groups (Table 1); ($p = 0.83$). Elastrator banded males exhibited more vocalizations between minutes 1 and 4 ($p < 0.01$). A trend can be seen in minutes 5 and 6 for banded males to vocalize more than All-in-One castrated males ($p = 0.09$ and $p = 0.08$, respectively). Banded males also were seen to vocalize more often across the entire 40 minute period (Table 2); ($p = 0.03$).

Restless Stress Behavior

Females that were docked with an elastrator band showed significantly more restless (standing and lying) behavior between 2 and 10 minutes ($p < 0.01$) and for the total duration of the observation period (Table 3); ($p < 0.01$). Males that were castrated with an elastrator band were significantly more restless than All-in-One castrated males during the total duration of the observation period (Table 4); ($p = 0.05$).

Behavior Score

Behavior scores did not differ among treatment groups for either sex of lambs (Table 5); ($p = 0.45$).

Weight Gain Performance

Females

No differences were seen in weight between the treatment groups for initial weight ($p = 0.73$), mean 22 day weight ($p = 0.88$), or mean 93 day weight ($p = 0.93$); (Table 6). There were also no differences in ADG for period 1 ($p = 0.85$), period 2 ($p = 0.68$) or total ADG ($p = 0.10$); (Table 6).

Table 1. Mean Vocalizations of ewe lambs docked with an All-in-One or Elastrator Band

Minutes	All-in-one	SE	Elastrator Band	SE	P-value
1	9.6	1.6	7.6	1.7	0.40
2	6.4	1.1	5.2	1.2	0.45
3	4.5	1.0	3.8	1.0	0.62
4	4.6	1.0	4.0	1.0	0.67
5	3.9	1.1	4.4	1.1	0.74
6	3.4	1.0	3.9	1.0	0.73
7	2.8	0.9	3.2	0.9	0.72
8	2.4	1.0	2.7	1.0	0.83
9	3.0	1.0	2.8	1.0	0.89
10	3.0	1.0	3.9	1.0	0.56
20	4.1	1.4	3.9	1.4	0.92
30	3.6	1.3	4.9	1.4	0.52
40	4.9	1.3	2.9	1.3	0.29
Total Vocal	56.1	9.8	53.1	10.2	0.83

Table 2. Mean vocalizations of wether lambs castrated with an All-in-One or Elastrator Band

Minutes	All-in-one	SE	Elastrator Band	SE	P-value
1	2.3	1.3	8.1	1.2	<0.01
2	0.4	0.7	4.1	0.6	<0.01
3	0.1	0.7	2.8	0.6	<0.01
4	0.2	0.8	3.9	0.8	<0.01
5	0.6	1.0	3.2	1.0	0.09
6	0.9	1.0	3.4	1.0	0.08
7	1.4	1.1	3.3	1.0	0.20
8	1.9	1.1	3.5	1.1	0.31
9	1.3	1.0	3.3	1.0	0.16
10	1.1	1.0	2.4	0.9	0.36
20	0.8	3.4	5.7	3.3	0.31
30	0.7	2.5	3.5	2.4	0.43
40	0.5	3.0	4.1	2.9	0.41
Total Vocal	12.1	12.4	51.1	11.9	0.03

Table 3. Mean restless behavior of ewe lambs docked with an All-in-One or Elastrator Band

	Minutes	All-in-one	SE	Elastrator Band	SE	P-value
Standing	1	0.06	0.08	0.13	0.08	0.52
	2	0.06	0.16	0.73	0.17	<0.01
	3	0.00	0.09	0.40	0.09	<0.01
	4	0.00	0.14	0.73	0.14	<0.01
	5	0.13	0.16	0.80	0.17	<0.01
	6	0.06	0.14	0.53	0.14	0.02
	7	0.06	0.17	1.00	0.17	<0.01
	8	0.06	0.15	1.13	0.16	<0.01
	9	0.13	0.14	0.93	0.14	<0.01
	10	0.06	0.24	1.13	0.25	<0.01
	20	0.31	0.14	0.53	0.15	0.28
	30	0.50	0.23	0.60	0.23	0.76
	40	0.38	0.13	0.13	0.13	0.20
	Total Stand	1.81	1.19	8.80	1.23	<0.01
Lying	1	0.00	0.11	0.40	0.11	0.02
	2	0.00	0.11	0.53	0.12	<0.01
	3	0.06	0.10	0.53	0.10	<0.01
	4	0.00	0.17	0.87	0.18	<0.01
	5	0.00	0.15	0.73	0.16	<0.01
	6	0.00	0.16	0.67	0.16	<0.01
	7	0.06	0.12	1.00	0.13	<0.01
	8	0.00	0.14	1.40	0.15	<0.01
	9	0.06	0.13	0.80	0.13	<0.01
	10	0.00	0.20	1.00	0.20	<0.01
	20	0.00	0.09	0.53	0.09	<0.01
	30	0.44	0.23	0.47	0.23	0.93
	40	0.31	0.10	0.07	0.10	0.09
	Total Lying	0.94	0.93	9.00	0.97	<0.01

Table 4. Mean restless behavior of wether lambs castrated with an All-in-One or Elastrator Band

	Minutes	All-in-one	SE	Elastrator Band	SE	P-value
Standing	1	0.21	0.11	0.20	0.11	0.93
	2	0.14	0.17	0.40	0.17	0.29
	3	0.07	0.17	0.47	0.16	0.10
	4	0.07	0.18	0.47	0.18	0.13
	5	0.00	0.22	0.60	0.21	0.06
	6	0.14	0.13	0.27	0.13	0.51
	7	0.07	0.13	0.40	0.17	0.08
	8	0.07	0.13	0.27	0.12	0.27
	9	0.07	0.17	0.60	0.16	0.03
	10	0.21	0.15	0.47	0.14	0.23
	20	0.36	0.24	0.73	0.23	0.27
	30	0.14	0.31	0.73	0.30	0.18
	40	0.14	0.23	0.60	0.22	0.16
	Total Stand	1.71	1.40	6.20	1.36	0.03
Lying	1	0.29	0.15	0.13	0.15	0.47
	2	0.14	0.17	0.40	0.17	0.29
	3	0.14	0.17	0.47	0.17	0.19
	4	0.07	0.18	0.40	0.18	0.21
	5	0.14	0.24	0.60	0.23	0.18
	6	0.07	0.13	0.33	0.12	0.15
	7	0.14	0.14	0.53	0.14	0.06
	8	0.07	0.11	0.33	0.10	0.09
	9	0.07	0.17	0.60	0.16	0.03
	10	0.21	0.18	0.80	0.18	0.03
	20	0.36	0.25	0.87	0.24	0.15
	30	0.57	0.38	0.93	0.37	0.50
	40	0.29	0.24	0.47	0.24	0.60
	Total Lying	2.57	1.48	6.87	1.43	0.05

Table 5. Mean Behavior scores for ewe and wether lambs

	All-in-one	SE	Elastrator Band	SE	P-value
Females	4.1	0.1	4.2	0.1	0.45
Males	3.7	0.2	4.0	0.2	0.34

Table 6. Mean body weight and ADG of ewe lambs docked with an All-in-One or Elastrator Band

	All-in-one	SE	Elastrator Band	SE	P-value
Initial Weight	7.1	0.4	7.3	0.4	0.73
Mean 22 Day Weight	15.3	0.9	16.1	1.0	0.88
Mean 93 Day Weight	30.4	1.1	30.5	1.2	0.93
Period 1 ADG	0.4	0.0	0.4	0.0	0.85
Period 2 ADG	0.2	0.0	0.2	0.0	0.68
Total ADG	0.3	0.0	0.3	0.0	0.10

Males

No differences were seen in weight between treatment groups for initial weight ($p = 0.50$) or mean 22 day weight ($p = 0.29$). However, the mean 93 day weight differed with elastrator band castrated males weighing more than All-in-One castrated males ($p = 0.03$); (Table 7). ADG did not differ between treatments for period 1($p = 0.24$) or period 2 ($p = 0.08$). Total ADG differed among treatments with elastrator band castrated males having a higher total ADG ($p = 0.02$); (Table 7).

Table 7. Mean body weight and ADG of wether lambs castrated with an All-in-One or Elastrator Band

	All-in-one	SE	Elastrator Band	SE	P-value
Initial Weight	7.0	0.5	7.5	0.5	0.50
Mean 22 day weight	15.2	1.1	16.8	1.0	0.29
Mean 93 Day Weight	29.3	1.3	33.4	0.2	0.03
Period 1ADG	0.4	0.0	0.4	0.0	0.24
Period 2 ADG	0.2	0.0	0.2	0.0	0.08
Total ADG	0.2	0.0	0.3	0.0	0.02

DISCUSSION

Females

While the elastrator band docking method did produce more restless behavior in ewe lambs, there were no differences in vocalizations, mean 22 day weight and mean 93 day weight. This indicates that the banding method is likely more painful to lambs and that they are able to compensate for weight loss due to stress. This agrees with the findings of Melches et al. (2006) that lambs are able to compensate for weight loss after a stressful procedure. Denniss et al. (1999) found that restlessness can be caused by unfamiliar sensations rather pain. This explains why lambs docked with a band were most restless but there were no differences in weight.

Grant (2004) concluded that docking lambs using a hot iron produced less pain in lambs than a band. They concluded that the iron severed nerve endings to the tail and left only receptors in the stump of the tail to convey pain. This could explain why lambs that were docked with a band produced more restless behavior than lambs docked with an All-in-One.

Males

Males that were castrated with the elastrator band exhibited more vocalization and more restless behavior. This indicates that elastrator bands cause more pain than an All-in-One. While the elastrator band method appears to cause more pain or discomfort to the lambs, the banded lambs had higher ADG, and higher mean 93 day weight. This indicates that male lambs are able to more than compensate for weight loss due to the minor pain of castration. This also agrees with the findings of Melches et al. (2006) that lambs can

compensate for weight loss after castration. Denniss et al. (1999) findings could also explain the behavior of males lambs castrated with a band.

Behavior Score

The behavior score did not differ among treatments or sexes. This suggests that after 60 minutes, all lambs are experiencing a similar amount of pain. It could also suggest that dams have an effect on how their lambs behave during a painful procedure. It is important to note that while docking and castration are painful procedures, the pain lasted only an hour before lambs resumed normal behaviors. Denniss et al. (1999) also found that lambs returned to normal behavior 60 minutes after castration.

IMPLICATIONS

While docking method can affect animal behavior, the results of this study indicate that it does not affect weight at weaning. Based on the results of this study, producers should utilize the method they are most comfortable with to dock lambs. Although the banding method appears to cause more pain indicating behavior, lambs castrated with a band had higher ADG and weaning weights. Based on the results of this study, producers should utilize the elastrator band method of castration to get the highest return at sale. Future research should focus on utilizing cortisol to determine stress in lambs that have been castrated or tail docked. This will give researchers another way to indicate pain besides pain indicating behaviors that can differ among individuals. Cortisol will also allow researchers to determine exactly how long lambs are in pain after a docking or castration procedure.

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